AITI Report
87-002

UCRL 15935
PO 1194803

Pratt and Whitney Technical Order Transfer Tests

June 12, 1987

Prepared for
Lawrence Livermore
National Laboratory
Air Force Logistics Command
AITI Project

Lawrence Livermore National Laboratory

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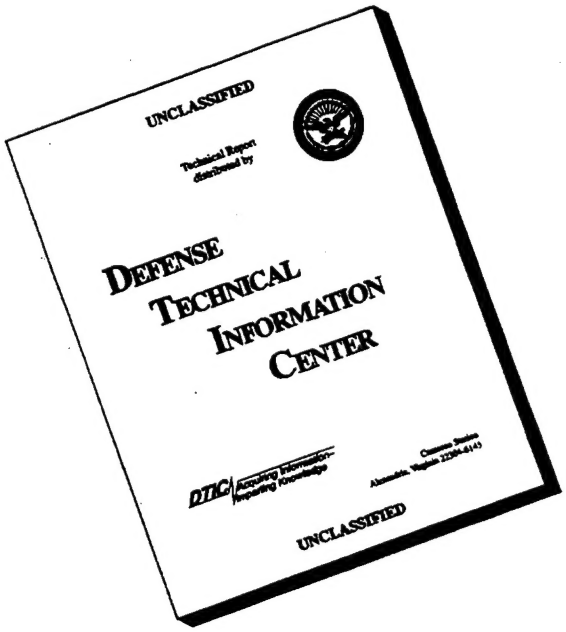

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Test	File Set	Document
SYSCON 87-01	P&W 87-01	AITI-Ref-1986-1
SYSCON 87-02	P&W 87-02	T.O. 8E1-3-4-3/AITI

Lawrence Livermore National Laboratory

Contents

1 Executive Summary

The AFLC/AITI Standards Project is testing the Military Standard for the Automated Interchange of Technical Information, MIL-STD-1840 (the Standard). The objective of the tests is to demonstrate the validity of the transfer protocol defined in the Standard itself and the viability of standardized formats for the transfer of technical information defined in other specifications used by the Standard.

Two documents (file sets) were prepared by Pratt and Whitney for this test. The documents were prepared in accordance with Appendix A of the December 12, 1986 version of the Standard. The file sets, on magnetic tape, were delivered to the ATOS laboratory facility at SYSCON Corporation, San Diego, California for testing. Each file set consisted of a declaration file, SGML tagged text files, IGES illustration files, and a raster image in CCITT group 4 format written on magnetic tape in accordance with FIPS PUB 75 and the Standard.

The tape format was in complete accordance with FIPS PUB 75. This critical point in the transfer process was successful. Almost any failure here would mean complete failure of the transmission. The declaration files were also completely acceptable.

The text files were less successful in meeting the requirements of the USAF SGML tagging scheme. The quality could be characterized as good for a first effort but not good enough for a production environment. After making a number of simple corrections, reasonable reproduction of the original could be generated. Inexperience and lack of automated quality control (AQC) tools account for the errors. Figure 1 shows the result of inadequate SGML coding of the tables.

Table 5-1. Test

Operator Action
1. Mount/load tape to be tested on tape drive.
2. Run TAPEVAL.COM command file.
3. Enter tape volume label at keyboard.

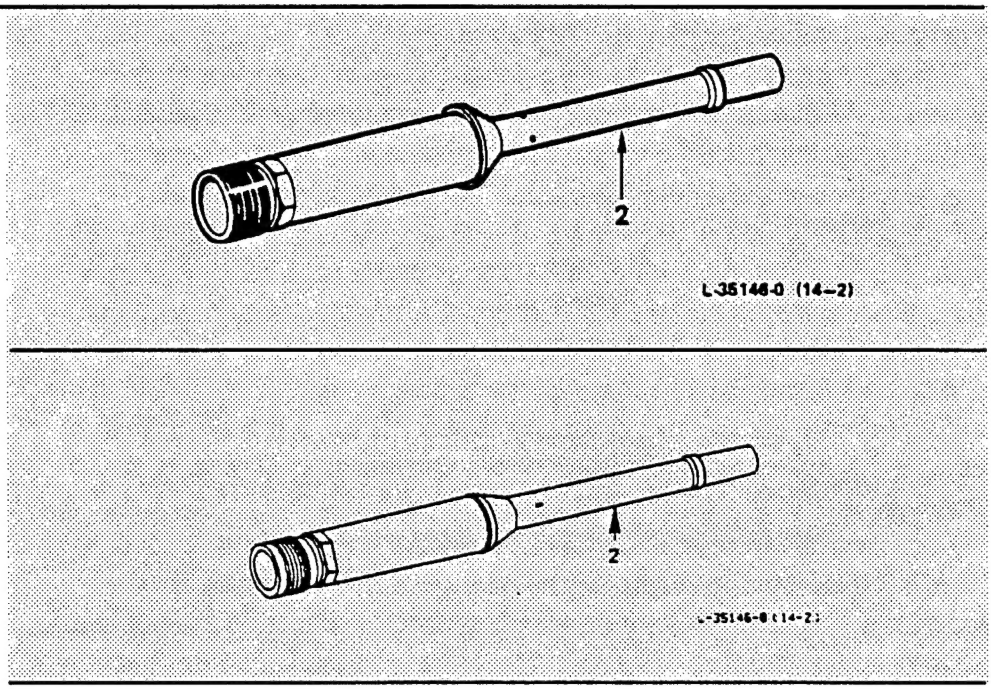
Table 5-1. Test F

Operator Action
1. Mount/load tape to be tested on tape drive.
2. Run TAPEVAL.COM command file.
3. Enter tape volume label at keyboard.

Figure 1.
Differences between Table 5-1 of T.O. AITI-Ref-1986-1 as originally published (left) and as transferred and processed (right) are attributed to inexperience in the use of SGML on the representation of tabular data.

The illustrations transmitted in IGES format matched the originally published illustrations very well except for the type font in the text callouts. Font problems with IGES have been noted since the beginning of the test program. In general, this part of the test was a success with the exception noted. Each file set contained one raster illustration in CCITT group 4 format. Neither of these could be read. The cause of this problem is as yet undetermined. One example of a successfully transferred illustration is shown in Figure 2.

Figure 2.
The illustration of a spark igniter from T.O. 8E1-3-4-3/ AITI as transferred as a MIL-STD-1840 file set (top) was reduced slightly in size in the as-published version (bottom).



The goal of the test was met, even with the deficiencies noted. Based on the results of this test and prior observation, it is recommended that:

1. Sending systems be provided with AQC tools and improved reference documentation to assist preparers of SGML text files.
2. IGES be improved with respect to text fonts, including alphabet size and set width specifications, and style and emphasis parameters.

Pratt and Whitney Transfer Tests Summary of Compliance to MIL-STD-1840 (12 December 1986).

Major Compliance Categories	File Set 1	File Set 2	Comments
Transmission Envelope			
ANSI Level 3 tape	pass	pass	
MIL-STD 1840 tape	pass	pass	
Declaration file	pass	pass	
Header records	part	part	Upper/lower case differences
SGML			
Correct use	pass	pass	
Required tags present	fail	fail	A few missing
Tags keyed correctly	fail	fail	Many errors
IGES			
V 3.0	fail	fail	
Parser/Verify	part	part	
Subset compliance	pass	pass	Only subset entities are available
All good images	part	part	Font problem
CCITT			
All good images	fail	fail	Files corrupted before transfer

pass = complaint in old respects
part = partial compliance, usable data
fail = noncompliant, unusable data
- = no graphic data in this form
* = unreadable tape

Explanation of Table of Summary of Compliance to MIL-STD-1840 (12 December 1986).

Major Compliance Categories	Explanation of Category
Transmission Envelope	**The "wrapper" around the documents**
ANSI Level 3 tape	The tape complies with FIPS PUB 79
MIL-STD-1840 tape	The tape complies with specific MIL-STD-1840 req'ments
Declaration file	The Document Declaration files are correct
Header records	The Header records for each data file are correct
SGML	**SGML tagged text files**
Correct use	The source system personnel understand SGML broadly
Required tags present	All required tags are present
Tags keyed correctly	All tags are keyed correctly
IGES	**Illustrations in IGES format**
V 3.0	The files are in conformance with Version 3.0
Parser/Verify	The file passes the parser/verifier without serious error
Subset compliance	The files comply with MIL-STD-1840 IGES subset req'ments
All good images	The IGES postprocessor produced an accurate image
CCITT	**Illustrations in CCITT Raster format**
All good images	Usable images can be derived from the data

pass = compliant in all respects
part = partial compliance, usable data
fail = noncompliant, unusable data
\- = no graphic data in this form
* = unreadable tape

2 File Set Preparation and Processing

The transmission tape was written at Pratt and Whitney, West Palm Beach, Florida on a VAX. The text files were prepared (tagged) initially on a Wang VS300 and then transferred to the VAX. The IGES illustrations were generated on an Auto-trol AGW 70 system and transferred by tape to the VAX. The CCITT raster illustrations were generated on an ANA-tech system and transferred by tape to the VAX.

Two documents were prepared by Pratt and Whitney for this test. The first document was the AITI Reference T.O. 86-1. The second was T.O. 8E1-3-4-3, Overhaul Instructions with Illustrated Parts Breakdown, Spark Igniters. The documents were prepared in accordance with Appendix A of the December 12, 1986 version of the Standard.

The file sets, on magnetic tape, were delivered to the ATOS laboratory facility at SYSCON Corporation, San Diego, California for testing. The initial tape processing and the majority of the testing was performed on a VAX. An Auto-trol AGW 70 was used to convert the IGES files to a CAD format and subsequently to a plotter format. The plotter files were then converted to a form acceptable to the QMS laser printer. Text hardcopy was output on the same printer.

Appended to the body of the report are paired exhibits of pages from both documents in their as-published form and in the as-transmitted and processed form.

The file sets were processed in the ATOS laboratory with a combination of specially built and commercially available software. Each file set consisted of a declaration file, SGML tagged text files, IGES illustration files, and a raster image in CCITT group 4 format written on magnetic tape in accordance with FIPS PUB 75 and the protocol specified in the Standard.

Pratt and Whitney prepared a Technical Report to accompany the magnetic tape. The Technical Report was particularly helpful with respect to some of the problems encountered during the processing of the text files and the CCITT group 4 file. It is recommended that all first time participants in the MIL-STD-1840 test program submit a similar report. The report provides an excellent basis for further communication, should it be necessary, during the progress of testing.

3 Test Results

The test results for the transmission envelope are presented first. Following that, the results for both documents are presented for the SGML text files, the IGES illustration files, and the raster illustration files.

Problem Numbering

In order to avoid repetitious statement of recurring problems encountered during the preceding year of testing, certain problems will be identified by numbering them according to the standard involved and the order of occurrence: for example, IGES-1 or SGML-3. When the same problem is encountered in a submission from a different sending system, it will be referred to by that number. These numbered problems will include only difficulties or deficiencies inherent in the Standard or the specifications on which the Standard calls. Problems attributable to preparation by the sending system or by vendor-supplied hardware/software will be identified separately and specifically.

Transmission Envelope

Analysis

The document transmission envelope consists of the tape and file labels (found "in" the magnetic tape), the document declaration files, and the header records for the text and illustration files. The envelope created by Pratt and Whitney would have been perfect, but for one flaw commonly observed in transmissions from other sources. The flaw should be classed as minor to medium in severity. The flaw, described below, did not prevent us from reading the files from the tape and testing the files to completion.

MIL-STD-1840 implies, but does not state directly, that the contents of certain records in the document declaration file should be repeated character for character in the header records of the text and illustration files. The declaration file and header records were not consistent in this respect.

The primary intent is to allow a human to read these records, in case of some problem with associating files with documents, and make a well-informed decision to resolve the ambiguity. A secondary intent was to permit machine processing of these records in a receiving inspection environment at the destination system. It has been noted many times that the maximum degree of automation in the transfer process is essential if MIL-STD-1840 is to be economically successful.

The test software was modified in this instance to permit upper/lower case differences without declaring an error. Examination of the logs shows that this did not solve the problem as it had in test data from other sources.

Statistics

The transmission contained two documents. The first document contained 8 text files, 9 IGES files and 1 raster file. The second document contained 8 text files, 5 IGES files and 1 raster file. Table 1 on the following page summarizes the statistics on file sizes.

Text Files

AITI-Ref-1986-1 Analysis

The text of the document was transmitted in 8 files. The files containing the list of effective pages (LEP) and the Table of Contents (TOC) were not composed on ATOS. ATOS automatically generates these elements of the document. The LEP and TOC files were, however, subjected to all other phases of the testing.

The printed original document (AITI RefTO 86-1) was produced in the ATOS laboratory at SYSCON, San Diego using SGML tags. In general terms, the purpose of this part of the validation test is to determine if a given application of SGML can adequately support the goals of the CALS policy as implemented by MIL-STD-1840. In a more specific sense, the purpose of this test was to discover if a printed document of known tagging characteristics (at the destination system) could be closely approximated in appearance and structure by the tags used by the sending system. This is intended as a test of the capability of a given application of SGML, and not as a test of the expertise of the SGML coders at the sending system. The reader is asked to keep the distinction in mind, since it is inevitable that the two issues become intertwined when test results are reported.

Table 1.
File Size Statistics
(in bytes)

Declaration File	AITI-Ref-1986-1 233	T.O. 8E1-3-4-3 246
Text Files		
TOO*S0001.	485	600
TOO*S0002.	610	593
TOO*S0003.	3,235	2,989
TOO*S0004.	2,982	3,351
TOO*S0005.	2,165	1,517
TOO*S0006.	6,743	3,686
TOO*S0007.	18,032	3,999
TOO*S0008.	12,119	3,364
Totals:	**46,371**	**20,099**
IGES Files		
FOO*Q0001.	100,480	97,440
FOO*Q0002.	35,840	67,040
FOO*Q0003.	244,480	318,480
FOO*Q0004.	195,520	175,280
FOO*Q0005.	114,240	96,800
FOO*Q0006.	122,800	
FOO*Q0007.	148,640	
FOO*Q0008.	9,600	
FOO*Q0009.	17,920	
Totals:	**989,520**	**755,040**
CCITT group 4 Files		
FOO*R0001.	14,848	15,872
Grand Total	**1,050,972**	**791,257**

The quality of the tagging by the sending system was very good, considering that it was a first effort. The level of understanding shown by the sending system with respect to the intent of the tags was good. In a few cases, required attributes were missing from a tag. In some other cases, tags were not properly terminated. Each of the tagging errors discovered was repaired, and a comment line inserted in the text file noting what repair had been made. In the listing of the file "pratt11.txt", these comment lines begin with the string "[co". This string, and any characters following it on the same line, is accepted by the ATOS text composition software as a comment and is not processed into the final

output. After the fixes were applied, the files were resubmitted to the error check process. Several invalid tags were found which nevertheless were accepted and interpreted by the Datalogics text composition software. The tags were <equals>, <tab>, <lt>, <gt>, and <commat>.

A representative list of discrepancies follows. The item number in the list corresponds to the handwritten circled numbers found in the exhibits. Not listed as discrepancies are the change version of the pages in the LEP, and the lack of change bars. The Pratt text files were coded with change bars. The ATOS job setup to compose the text treated the input files as a "no change" document, and thus the lack of change bars, etc. The numbers of the list items correspond to handwritten circled numbers on the reproduced pages of the Pratt version of the document.

1. The note on the cover page differs substantially from the original.

2. Cover page "Change 1 - Change - 1 ..."

   Refer to Exhibits 1 and 2.

3. Page 1-1. Subparagraph 1-1.a. did not exist as a subparagraph in the original.

4. Page 1-1. Note the underscore preceding the first word of this subparagraph and all subsequent on this page. This is probably an artifact introduced while correcting the invalid tag "<bsol>". The corrected file has a space code between the tag and the "" which is the probable use of the underscore.
5. Page 1-1. The references were tagged as a list in the original. Pratt coders used <p1> instead.

   Refer to Exhibits 3 and 4.

6. Page 2-1. The first subparagraph title has an extra underscore character at the end of the title. This occurs throughout the document where Pratt coders used the emphasis tags to cause title underscoring, not realizing that the ATOS implementation of SGML would automatically perform underscore at that subparagraph level. The cause of the extra underscore character is a space character after the period in the title and the "</emph>" tag.

7. Page 2-1. The space reservation for Figure 2-1 was not made. There was no tag "<figure ..." for Figure 2-1. On page 3-1, the size of the space reservation for Figure 3-1 is different from the original, thereby a different number of characters on the page.

   Original
   <figure width=30. depth=30. graphic=no>
   <title>Small Sample Test Schedule

   Pratt tags
   <figure width=38. depth=25. float=N>
   <title> Small Sample Test Schedule

   The difference in "depth=" accounts for the smaller space reservation in the Pratt version. In this case, the Pratt coders had to guess how the SGML implementation would "set" the figure. The fact that they guessed wrong does not bear on the validity of the SGML application.

8. Page 4-1. In the original, the first subparagraph was identified with "a.". The Pratt coders used the tag "<p2>" following the tag "<p0>", causing an error in hierarchy.

9. Page 4-1. The backslash following the subparagraph titles is probably caused by the use of the emphasis tags between the "<Pn>" and the backslash to end the title.

10. Page 4-1. The descriptions of RECORD 5 and RECORD 9 use the equal sign "=" rather than the string "<=". The invalid tag <equals> was coded in the text.

    Refer to Exhibits 5 and 6.

11. Page 5-1. The composed Pratt version of this page shows the double column page with the columns justified evenly with each other. The original showed the two columns as uneven, with the left column running longer. The difference is due to unequal format table configurations over time in the ATOS text composition software. The difference is not due to choice of SGML tags.

12. Page 5-8. The table resulting from the coding by Pratt is noticeably different in presentation than the original.

    Refer to Exhibits 9a, 9b, and 10.

Some conclusions may be drawn by analyzing the detail represented by the preceding representative comments.

The Standard assumes that all sending systems employ full ASCII keyboards in their text processing systems. That was not the case for this sending system, where a well known word processing system was used. If an aerospace contractor is selected to provide data, that contractor should be warned that the SHORTREF character "" is needed.

The difficulties with the table were expected. The application of SGML used for this test has been greatly revised with respect to table tagging in DOD-M-(SGML). Preliminary review of the new military specification is encouraging in this regard.

It is clear that the vast majority of the coding errors were due to inexperience with the SGML application being used and with the absence of an automated quality control (AQC) tool. In this test environment, inexperience with the SGML application may be taken as a "given," and is, therefore, not significant.

The absence of simple AQC tools is significant. Almost all of the coding errors detected by the laboratory preprocessing software and the text composition software at the destination system could have been detected by an AQC tool at the sending system and, therefore, corrected.

These errors can be attributed to many other causes, none of which are acceptable given the intent to validate the use of an SGML application. Some of the causes are:

a. inadequate reference documentation used by "taggers"

b. inadequacies of the SGML application itself

c. idiosyncrasies in the SGML implementation software

For the sake of discussion, suppose that all of the above have some degree of validity. The certainty that an application of SGML will fulfill the intent of CALS policy is diluted by the same degree that each of the above "causes" is valid. Therefore it would seem that immediate action to repair the above items used as criteria should be taken.

There were a number of spelling errors in the text files. The errors were detected by the spelling checker used by ATOS. In the listing of spellerr.srt, where duplicates are deleted, 13 of the 25 words listed are acronyms or names for programs or files. This would seem to lend some support for restoring the Special Words file (exception list addendum for spelling check software) to MIL-STD-1840A. The remainder of the words (except two) are actually misspelled. Two legitimately spelled words, "asks" and "sanity" were rejected by the spelling checker. There are three problems bundled together in this one list: false errors due to unrecognized acronyms and other special words, false errors due to rejecting legitimate words, and true errors in spelling. The latter again points up the need to supply AQC tools (or validate the sending system tools).

In general, it seems to be time to de-emphasize acceptance of text files based on the their appearance after composition and printing in favor of a more rigorous and reliable tag analysis software.

AITI-Ref-1986-1 Statistics

Table 2 on the next page shows the file size in bytes and the number of tags in each of the eight text files. The statistics do not include the "[co" comment lines used to record fixes to the text files.

Table 2.
Text File Sizes-DOC001.

File Name	Bytes	Tags
T001S0001.	485	12
T001S0002.	610	40
T001S0003.	3,235	219
T001S0004.	2,982	26
T001S0005.	2,165	16
T001S0006.	6,743	86
T001S0007.	18,032	168
T001S0008.	12,119	136
Totals	**46,371**	**703**

T.O. 8E1-3-4-3 Analysis

As with the first document, there were a number of tagging errors. The errors ran the gamut from invalid tags to missing tag delimiters. None of the errors would have escaped the notice of a simple AQC tool such as is in use here in the ATOS laboratory. In general, the remarks made about

the first document apply equally to this document. Refer to Exhibits 11, 12, 13, 14a, and 14b.

T.O. 8E1-3-4-3 Statistics

Table 3 shows the file size in bytes and the number of tags in each of the eight text files. The files did not include the "[co" comment lines used to record fixes to the text files.

Table 3.
Text File Sizes - DOC002.

File Name	Bytes	Tags
T002S0001.	600	17
T002S0002.	593	41
T002S0003.	2,989	205
T002S0004.	3,351	86
T002S0005.	1,517	64
T002S0006.	3,686	72
T002S0007.	3,999	74
T002S0008.	3,364	86
Totals	**20,099**	**645**

IGES Files

AITI-Ref-1986-1 Analysis

The most significant finding is that the images transferred with near perfect accuracy. The less than perfect aspect had to do primarily with font definitions. Refer to Exhibits 7 and 8, and 13 and 14b.

IGES-1 - IGES (Version 3.0) does not have the capability to identify fonts that will match the area defined for the note (entity 212). This deficiency presents a serious problem for those contemplating the use of MIL-STD-1840. Text in illustrations must be manipulated at the destination system to fit the apparent intended note area, but the amount of manual intervention required to achieve this "cut and try" solution makes a mockery of the "A" in AITI. A proposed solution is described below.

It is recommended that the capability of IGES be expanded to include the parameterized definition of several fonts. Parameterized fonts would permit the exchange of illustrations with text callouts without requiring manual intervention at the receiving system to make the ASCII strings fit in the intended callout area on the illustration.

The font names would characterize the appearance of the font, e.g., serif, sans serif, hand lettering, monospace typewriter, etc. Each of these (few) fonts would be parameterized for a single size (such as 10 points) so that different type sizes could be computed from the reference font. The single most important set of parameters for any font would be the width of each character for the reference font. This would permit two different CAD systems to place the same strings of characters (ASCII) in the same size callout area, even if the two implementations of the font have slightly different appearances. Other parameters would define character weight (light, normal, bold), embellishment (underscore, strike through, etc.), slanting or italicizing, and others to be defined.

1840A-1 - MIL-STD-1840 and MIL-STD-1840A identify, in Appendix A, a subset of IGES entities to be used for transmission of illustrations in technical documents. The objective was to assure that the sending system would not use an entity that could not be accepted by the destination system. As a part of the definition of the entities, certain parameters are specified. One of these is the level to which the entity is assigned. For some reason, the drafters of the specification for the entities thought that forcing all entities to level zero was desirable. (It should be noted that all submissions to date have cheerfully ignored this requirement.)

Forcing all entities to level zero makes the preparation process more difficult and does not help the destination system to accept the entities more readily. Further, it removes valuable information from the set of entities. Assignment of parts of an illustration to different levels makes the process of illustration maintenance much easier.

Most IGES postprocessors will either accept the entity level assignment as is or assign the entity to a default level. It is recommended that the restriction on entity level assignment be dropped entirely.

Vendor Related Problems

It is clear from examination of the log file output from the IGES Data Analysis (IDA) Parser and Verify software that there are several points on which IDA and Auto-trol disagree in regard to interpretation of the IGES requirements. Both parties have been supplied with copies of the log files along with a request to "do something." No further action from this end is planned at this time. If there are true deficiencies in the Auto-trol IGES preprocessor output, they will not be found by submitting the file to an Auto-trol IGES postprocessor.

AITI-Ref-1986-1 Statistics

The statistics tabulated below were compiled from the output generated by the IGES Data Analysis Parser and Verify software. The complete listings follow the text of this section.

Table 4 presents data on the number of records in the file for each illustration. The nine relatively simple illustrations in this document required 12,369 records and nearly one million bytes for transmission in IGES uncompressed ASCII format.

Table 4.
Count of Records Per Section In Data File

Section	1	2	3	4	5	6	7	8	9	Total
Start	1	1	1	1	1	1	1	1	1	9
Global	2	2	2	2	2	2	2	2	2	18
Directory	812	286	1668	1496	860	922	1102	60	112	7318
Parameter	440	158	1384	944	564	609	752	56	108	5015
Terminate	1	1	1	1	1	1	1	1	1	9
Totals	**1256**	**448**	**3056**	**2444**	**1428**	**1535**	**1858**	**120**	**224**	**12369**

12,369 records of 80 bytes = 989,520 bytes

Table 5 presents data on the count of entity types and forms of entities within type, shown by the level to which the entity and form combination was assigned. If it were not for the varying levels of assignment the table would consist of only four rows. That is, a single form was used for each entity type.

Table 6 shows the entity count by level for each of the illustrations. The row of data below is extracted from Table 6.

Bytes/entity										
Average	247	251	293	261	266	266	270	320	320	277

It shows the average number of bytes per entity for the nine files. The last entry is an average of the averages (277). Files 8 and 9 were very small illustrations containing text in a table. Perhaps it would be beneficial to

Table 5.
Entity Occurrence Counts

File number												
106	11	0	0	0	202	0	0	0	0	1	1	204
106	11	1	2	2	1	48	21	22	25	0	0	121
106	11	2	11	4	0	0	0	0	0	0	0	15
106	11	3	1	0	0	0	0	0	0	0	0	1
106	11	4	0	0	21	21	13	14	15	0	0	84
106	11	6	0	0	0	6	0	0	0	0	0	6
110	0	0	0	0	98	0	0	0	0	4	4	106
110	0	1	166	126	1	139	68	71	131	0	0	702
110	0	2	0	1	0	0	0	0	0	0	0	1
110	0	4	0	0	442	462	286	308	332	0	0	1830
110	0	5	206	0	0	0	0	0	0	0	0	206
110	0	6	0	0	0	38	0	0	0	0	0	38
116	0	0	0	0	22	0	0	0	0	0	0	22
116	0	1	0	0	0	8	10	12	19	0	0	49
212	1	6	20	10	47	26	32	34	29	25	51	274
Total			**406**	**143**	**834**	**748**	**430**	**461**	**551**	**30**	**56**	**3659**

Table 6.
Entity Count by Level

Level	Count									
0	0	0	322	0	0	0	0	5	5	332
1	168	128	2	195	99	105	175	0	0	872
2	11	5	0	0	0	0	0	0	0	16
3	1	0	0	0	0	0	0	0	0	1
4	0	0	463	483	299	322	347	0	0	1914
5	206	0	0	0	0	0	0	0	0	206
6	20	10	47	70	32	34	29	25	51	318
Total	**406**	**143**	**834**	**748**	**430**	**461**	**551**	**30**	**56**	**3659**
Bytes/entity Average	247	251	293	261	266	266	270	320	320	277

users of MIL-STD-1840 to encourage IGES pre- and postprocessor vendors to implement the ASCII compression algorithm supplied in Appendix G of version 3.0 of the IGES document.

T.O. 8E1-3-4-3 Analysis

The difficulties encountered with the second document did not differ in any significant respect from the first document. That is, the problems identified and numbered for the first document apply here exactly as stated. The remarks about possible deficiencies in the Auto-trol pre-processor output also apply equally here.

T.O. 8E1-3-4-3 Statistics

The statistics tabulated below were compiled from the output generated by the IGES Data Analysis Parser and Verify software. The complete listings follow the text of this section.

Table 7 presents data on the number of records in the file for each illustration. The five illustrations in this document required 9,438 records and .75 million bytes for transmission in IGES uncompressed ASCII format.

Table 7.
Count Of Records Per Section In Data File

Section	File number 1	2	3	4	5	Total
Start	1	1	1	1	1	5
Global	2	2	2	2	2	10
Directory	422	504	2020	1128	418	4492
Parameter	792	330	1957	1059	788	4926
Terminate	1	1	1	1	1	5
Total	**1218**	**838**	**3981**	**2191**	**1210**	**9438**

9438 records of 80 bytes = 755040

Table 8 presents data on the count of entity types and forms of entities within type, shown by the level to which the entity and form combination was assigned. If it were not for the varying levels of assignment the table would consist of only four rows. That is, a single form was used for each entity type.

Table 8.
Entity Occurrence Counts

Entity	Form	Lvl	1	2	3	4	5	Total
106	11	0	0	0	0	22	0	22
106	11	1	81	34	0	0	81	196
106	11	2	0	0	222	0	0	222
106	11	4	2	6	16	184	2	210
106	11	6	0	0	0	5	0	5
110	0	0	0	0	0	9	0	9
110	0	1	63	60	0	0	63	186
110	0	2	0	0	240	0	0	240
110	0	4	60	133	487	327	60	1067
116	0	2	0	10	10	0	0	20
116	0	4	0	0	0	1	0	1
116	0	6	0	0	0	5	0	5
212	1	4	0	0	0	4	0	4
212	1	6	5	9	35	7	3	59
Total			**211**	**252**	**1010**	**564**	**209**	**2246**

Table 9 shows the entity count by level for each of the illustrations. The row of data below is extracted from Table 9. It shows the average number of bytes per entity for the five files. The last entry is an average of the averages (336). Perhaps it would be beneficial to users of MIL-STD-1840 to encourage IGES pre- and postprocessor vendors to implement the ASCII compression algorithm supplied in Appendix G of version 3.0 if the IGES document.

Bytes/entity Average	462	266	315	311	463	336

Table 9.
Entity Count by Level

Level	Count					
0	0	0	0	31	0	31
1	144	104	0	0	144	392
2	0	0	472	0	0	472
3	0	0	0	0	0	0
4	62	139	503	516	62	1282
5	0	0	0	0	0	0
6	5	9	35	17	3	69
Total	**211**	**252**	**1010**	**564**	**209**	**2246**
Bytes/entity Average	462	266	315	311	463	336

CCITT Files

The transfer of CCITT group 4 data was completely unsuccessful for both of the raster files submitted (one for each document). Some effort was expended on diagnosing the problem, but without any success.

4 Summary of Recommendations

AQC Tools For Text Files.

It is recommended that sending systems be provided with AQC tools and improved reference documentation to assist preparers of SGML text files. The primary AQC tool would be a tag analyzer (lexical scanner and syntax parser).

To achieve optimum utility, the tag analyzer should have the following characteristics:

a. be written in a highly transportable high level language

b. be table driven by application syntax statements conforming to ISO 8879

c. be completely public and available for critical examination by anyone

In its early stages of development, the tag analyzer would serve as the simple AQC tool mentioned above. In later stages, it would provide the more sophisticated syntax analysis required to assure that a given instance of a document tagged in accordance with DOD-M-(SGML) is correct within the definition of that application.

IGES Improvements

It is recommended that the capability of IGES be expanded to include the parameterized definition of several fonts. Parameterized fonts would permit the exchange of illustrations with text callouts without requiring manual intervention at the receiving system to make the ASCII strings fit in the intended callout area on the illustration.

The font names would characterize the appearance of the font, e.g., serif, sans serif, hand lettering, monospace typewriter, etc. Each of these (few) fonts would be parameterized for a single size (such as 10 points) so that different type sizes could be computed from the reference font. The single most important set of parameters for any font would be the width of each character for the reference font. This would permit two different CAD systems to place the same strings of characters (ASCII) in the same size callout area, even if the two implementations of the font have slightly different appearances. Other parameters would define character weight (light, normal, bold), embellishment (underscore, strike through, etc.), slanting or italicizing, and others to be defined.

MIL-STD-1840A

It is recommended that the restriction imposed by MIL-STD-1840A on the level assignment for IGES entities be dropped entirely.

5 Exhibits

Exhibits 1 through 14b follow this page. The exhibits are marked in the manner referred to in the body of the report. The table that follows numbers and describes the exhibits.

Table 10.
Exhibits

Publication Number, Abbreviated Title, and List of Exhibit Pages		
AITI-REF-1986-1 AITI Validation Test Plan		
Cover	Exhibit 1	As published
	Exhibit 2	As transmitted and processed
Text page	Exhibit 3	As published
	Exhibit 4	As transmitted and processed
Text page	Exhibit 5	As published
	Exhibit 6	As transmitted and processed
Illus., page	Exhibit 7	As published
	Exhibit 8	As transmitted and processed
Text (table) page	Exhibit 9a	As published
	Exhibit 9b	As published
	Exhibit 10	As transmitted and processed
T.O. 8E1-3-4-3	**Overhaul Instructions... Spark Igniters**	
Cover	Exhibit 11	As published
	Exhibit 12	As transmitted and processed
Page	Exhibit 13	As published
	Exhibit 14a	Text as transmitted and processed
	Exhibit 14b	Illus. as transmitted and processed

AITI-Ref-1986-1

Test Plan

VALIDATION TEST PLAN FOR MIL-STD-1840 (USAF) AUTOMATED INTERCHANGE OF TECHNICAL INFORMATION

SYSCON CORPORATION
LAWRENCE LIVERMORE NATIONAL LABORATORY
Subcontract 8914805

1986 OCTOBER 24

CHANGE 1 - 1986 December 15

AITI-Ref-1986-1

Test Plan

VALIDATION TEST PLAN FOR MIL-STD-1840 (USAF) AUTOMATED INTERCHANGE OF TECHNICAL INFORMATION

SYSCON CORPORATION
LAWRENCE LIVERMORE NATIONAL LABORATORY
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(1)

1986 OCTOBER 24

CHANGE 1 - CHANGE 1 - 1986 December 15

(2)

SECTION I

GENERAL

1-1. PURPOSE OF THE TEST PLAN. The Test Plan for verifying the validity and completeness of the body and the Technical Publication Application appendix of the MIL-STD-1840 (USAF) Automated Interchange of Technical Information (the Standard) has been prepared to fulfill the following objectives:

- To provide guidance for the management and technical effort necessary throughout the test period.
- To establish a comprehensive test plan and to communicate to the sponsor the nature and extent of the tests deemed necessary to provide a basis for evaluation of the Standard.
- To coordinate with the sponsor an orderly schedule of events, a specification of equipment and organizational requirements, the methodology of testing, a list of materials to be delivered, and a schedule of tests.
- To provide a written record of the actual test inputs to validate the system limits and critical capabilities, the instructions to permit execution of the test by the staff and operator personnel, and the expected outputs.

It is intended that the tests demonstrate the practicality of the AITI Standard (reference d) and that the tests generate a benchmark database. The database will be representative of the many document types and will serve as a benchmark for anyone wishing to employ the AITI Standard.

1-2. PROJECT REFERENCES.

Government Publications -

1. FIPS PUB 79 Magnetic Tape Labels and File Structure for Information Interchange (ANSI, X3.27-1978)

2. FIPS PUB 25 Recorded Magnetic Tape for Information Interchange (1600 CPI, PE) (ANSI X3.39-1973)

3. FIPS PUB 50 Recorded Magnetic Tape for Information Interchange (6250 CPI, Group-coded Recording (ANSI X3.54-1976)

4. MIL-STD-1840 (USAF) Automated Interchange of Technical Information. 11 September 1986. Draft Revision 15 December 1986.

5. Text Standard Generalized Markup Language, Automated Technical Order System (ATOS). ATOS Project Office (OO-ALC/MMED-3) Hill AFB, Utah 84056. 23 May 1986. Prepared by Datalogics under contract F42650-85-C3410.

6. FED-STD 1065 - Telecommunications: Facsimile Coding Schemes and Coding Control Functions for Group 4 Facsimile Apparatus

Non-government publications -

7. American National Standard for Unrecorded Magnetic Tape for Information Interchange (9-track 200 and 800 CPI, NRZI, and 1600 CPI, PE), ANSI X3.40-1983

8. Initial Graphics Exchange Specification (IGES), Version 3.0, NBSIR 85-3359, U.S. Department of Commerce, National Bureau of Standards, April 1986.

9. Information Processing Systems - Text Preparation and Interchange - Processing and Markup Languages - Part Six: Generic Document Representation Specification (SGML). International Standard ISO 8879. ISO TC97 SC18/WG8, USA Secretariat: ANSI

SECTION I

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- To provide a written record of the actual test inputs to validate the system limits and critical capabilities, the instructions to permit execution of the test by the staff and operator personnel, and the expected outputs.

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i. Information Processing Systems - Text Preparation and Interchange - Text Preparation and Interchange - Processing and Markup Languages - Part Six: Generic Document Representation Specification (SGML). International Standard ISO 8879. ISO TC97/SC18/WG8, USA Secretariat: ANSI.

SECTION IV

TEST SPECIFICATION AND EVALUATION

4-1. TEST SPECIFICATION. This section presents four major topics: the test requirements, the test methodology, the progression of tests, and the evaluation of test results.

a. Requirements. The test requirements are allocated to four categories: magnetic tape media, the Document Declaration File, the Text files, the IGES files, and the CCITT group 4 files.

(1) Magnetic Tape Media Requirements. To be accepted, the magnetic tape must meet the following requirements.

1. The magnetic tape must be formatted in accordance with FIPS PUB 79 (reference 1).

2. The tape volume and file labels shall conform with level three or level four of FIPS PUB 79.

3. The data must be written on 9-track tape at a density of 1600 or 6250 bpi in accordance with FIPS PUBS 25, 50, 79 (references 2, 3, 1).

4. The tape volume identifier must consist of six characters. The first four characters shall identify the set and the last two character shall consist of the digits 0-9 and represent the number of the tape volume in the set.

5. The characters in the label must be limited to the ASCII uppercase letters and the digits 0-9.

6. The Document Declaration and Text files must be recorded with ANSI (reference 7) type D variable length records with block lengths of 2048 bytes.

7. The IGES (reference 8) files must be recorded with ANSI type F fixed length 80 byte records with block lengths of 2000 bytes.

8. The CCITT group 4 (reference 6) files must be recorded with the first block containing the the required header records in ANSI type F fixed length records with padding to 2048 bytes. The CCITT data must be written with 128 byte ANSI type F records in blocks of 2048 bytes.

9. The Document Declaration file(s) must precede all other types of files on the tape volume(s).

10. The data files must be grouped in the same order as the Document Declaration files. Files from different documents shall not be intermixed.

11. All records in the Document Declaration File and all header records specified for the text and illustration files are required.

(2) Document Declaration File Requirements. To be accepted, a Document Declaration file must meet the following requirements.

1. The filename and all records in the file must be ASCII characters.

2. The filename must contain exactly six characters.

3. The filename must be unique with respect to any other file name to be found in the set of files being transferred.

4. The first three characters of the filename must be 'DOC'.

5. The record type must be ANSI type D.

6. The record lengths must range from one byte to 256 bytes.

7. RECORD 1 - must contain an ASCII string agreed upon by the data source and the destination (SYSCON).

8. RECORD 2 - must contain an agreed upon ASCII string.

9. RECORD 3 - must contain an agreed upon ASCII string, or 'NONE'.

10. RECORD 4 - must contain an agreed upon ASCII string, or 'ORIGINAL'.

11. RECORD 5 - must contain an eight character string representing the date in the format YYYYMMDD, where 1970 ≤ YYYY ≤ 1987; 01 ≤ MM ≤ 12; 01 ≤ DD ≤ 31.

12. RECORD 6 - must contain an agreed upon ASCII string.

13. RECORD 7 - must contain an agreed upon ASCII string.

14. RECORD 8 - must contain an agreed upon ASCII string, or 'NONE'.

15. RECORD 9 - must contain an eight character string representing the date in the format YYYYMMDD, where 1986 ≤ YYYY ≤ 1987; 01 ≤ MM ≤ 12; 01 ≤ DD ≤ 31.

16. RECORD 10 - must contain an agreed upon ASCII string, or 'NONE'.

17. RECORD 11 - must contain one, two, three or four groups of ASCII digits. The groups must be separated with a comma. A space code following the comma is acceptable. The first group must

SECTION IV

TEST SPECIFICATION AND EVALUATION

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e. The characters in the label must be limited to the ASC uppercase letters and the digits 0-9.

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g. The IGES (reference 8 files must be recorded with ANSI type F fixed length 80 byte records with block lengths of 2000 bytes.

h. The CCITT group 4 (reference 6) files must be recorded with the first block containing the required header records in ANSI type F fixed length records with padding to 2048 bytes. The CCITT data must be written with 128 byte ANSI type F records in blocks of 2048 bytes.

i. The Document Declaration file(s) must precede all other types of files on the tape volume(s).

j. The data files must be grouped in the same order as the Document Declaration files. Files from different documents shall not be intermixed.

k. All records in the Document Declaration File and all header records specified for the text and illustration files are required.

(a) Document Declaration File Requirements. To be accepted, a Document Declaration File must meet the following requirements.

l. The filename and all records in the file must be ASCII characters.

m. The filename must contain exactly six characters.

n. The filename must be unique with respect to any other file name to be found in the set of files being transferred.

o. The first three characters of the filename must be 'DOC'.

p. The record type must be ANSI type D.

q. The record lengths must range from one byte to 256 bytes.

r. RECORD 1 - must contain an ASCII string agreed upon by the data source and the destination (SYSCON).

s. RECORD 2 - must contain an agreed upon ASCII string.

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v. RECORD 5 - must contain an eight character string representing the data in the format YYYYMMDD, where 1970 = YYYY = 1987; 01 = MM = 12; 01 = DD = 31.

w. RECORD 6 - must contain an agreed upon ASCII string.

x. RECORD 7 - must contain an agreed upon ASCII string.

y. RECORD 8 - must contain an agreed upon ASCII string, or 'NONE'.

z. RECORD 9 - must contain an eight character string representing the data in the format YYYYMMDD, where 1986 = YYYY = 1987; 01 = MM = 12; 01 = DD = 31.

aa. RECORD 10 - must contain an agreed upon ASCII string, or 'NONE'.

ab. RECORD 11 - must contain one, two, three or four groups of ASCII digits. The groups must be separated with a comma. A space code following the comma is acceptable. The first group must

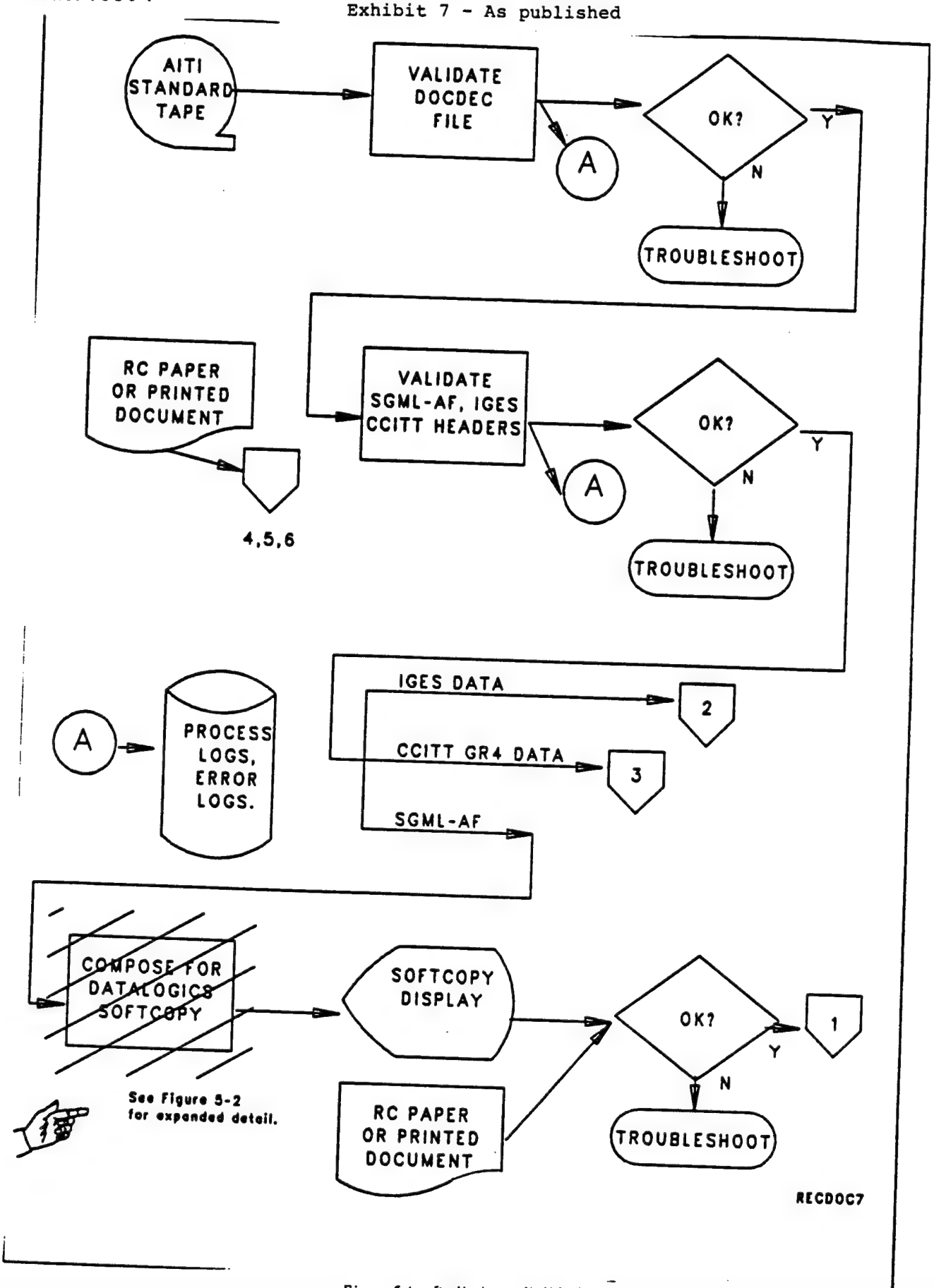

Figure 5-1. Preliminary Validation.

Exhibit 8 - As transmitted and processed

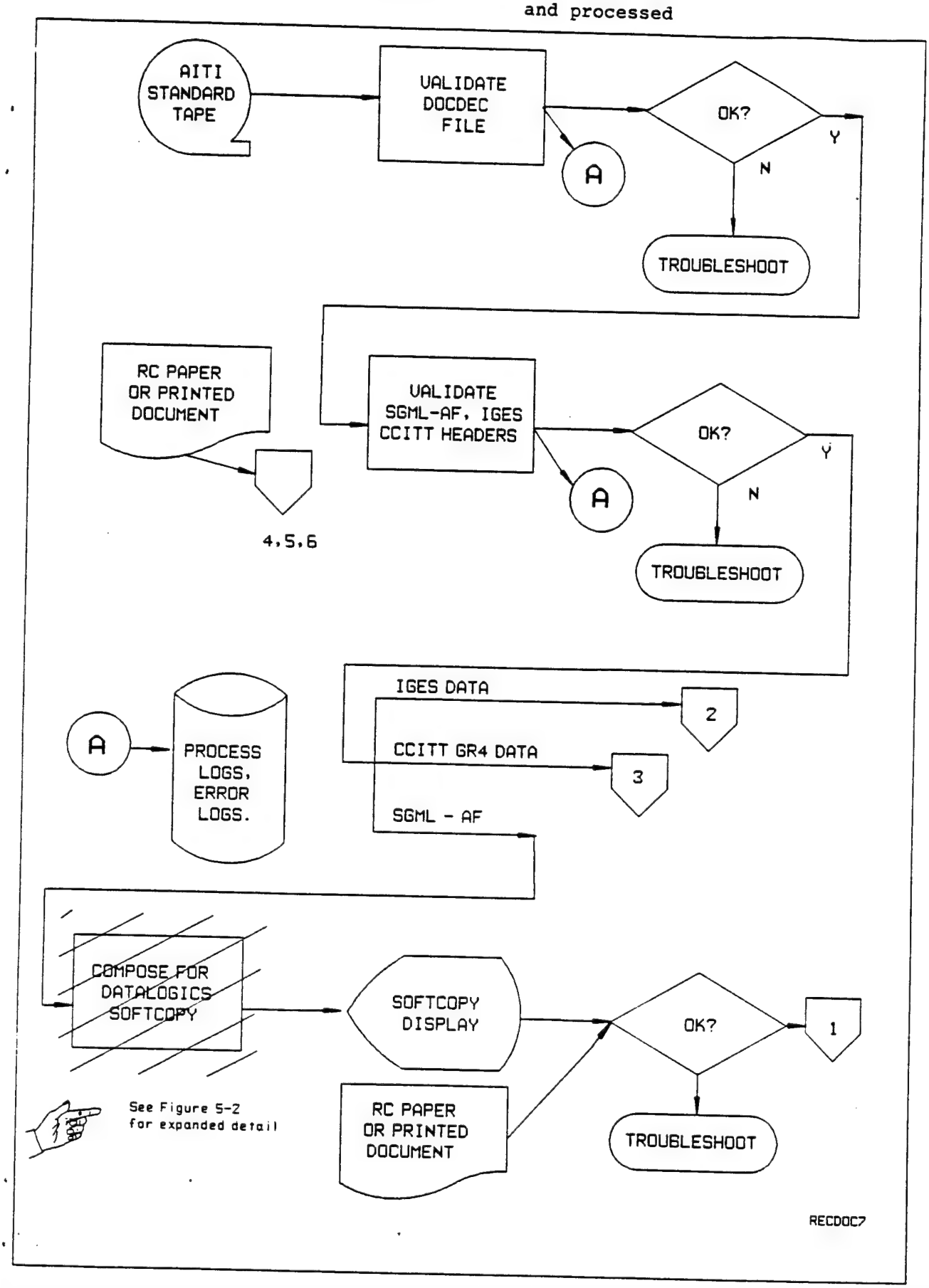

Table 5-1. Test Procedure for TAPEVAL Magnetic Tape Validation Program.

Operator Action	Test Step/Expected Result	Pass/Fail Criteria
1. Mount/load tape to be tested on tape drive.		
	Tape mounted and at load point.	
		load/ready light displayed on tape unit.
2. Run TAPEVAL.COM command file.		
	Prompt displayed to enter tape volume label.	
3. Enter tape volume label at keyboard.		
	Prompt displayed to enter root directory to contain output files.	
4. Enter root directory at keyboard.		
	Prompt displayed for directory to contain tape label block scan results.	
5. Enter directory to receive SCANTAPE results.		
	Tapes moves across all documents on tape and then rewinds.	
		Successful tape Mount Message appears here.
	Display asks for directory to store FNVAL results in.	
6. Enter directory to store file name validations in FNVAL.		
	Display asks if ti is OK to continue?	
7. Enter Y if FNVAL gave a good return.		
	Files are copied to system in preparation for header scan.	
	Display asks for directory to contain DOCDECVAL header scan results.	
8. Enter directory to store header results form DOCDECVAL execution.		
		TAPEVAL has run to completion.

Table 5-1. Test Procedure for TAPEVAL Magnetic Tape Validation Program.

Operator Action	Test Step/Expected Result	Pass/Fail Criteria
9. Print the catalog and process log files.		

i. Examine log files for any unrepaired discrepancies. Repair as required to continue test.

j. Using ATOS Manager menu and LEP gencode, define an ATOS job for this document. (ATOS staff will automate this process in '87.)

k. logout of AITI account.

l. Login to ATOS as DLHOWE , type in 'MENU' and select the 'jobname', type in 'P' then type in 'E'. Get the menu listing from the line printer.

m. Change directory to the 'jobname' directory.

- CD [.'jobname']
- COPYTOOLS 'jobname'

n. Using EDIT, make appropriate adjustments to the PSAVEFILES*.DAT files. PSAVEFILES.DAT must have as many blank lines followed by 'E' as there are components listed on the menu print out. PSAVEFILES3.DAT must have the ordinal number of the TOC component and then an 'E'. PSAVEFILES2.DAT must have the ordinal number of the LEP component and then a 'E'.

o. Copy text file components from the Test data directory to appropriate DLHOWE directories. If there is not a regular correspondence between the MARKUPnnnn.TXT filenames and the ATOS component numbers, make a correspondence list for copying files. (Written. MOVEFILES.COM, COPYFILES.COM, DOEXTRACT.COM, MOVEFILES.DAT)

- @MOVEFILES 'jobname'

p. After composition for EXTRACT is complete, PSAVE ALL and select TOC for EXTRACT. (Written. PSAVEFILES.COM, PSAVEFILES.DAT, PSAVEFILES2.DAT, PSAVEFILES3.DAT)

- @PSAVEFILES 'jobname'

q. After TOC composition for EXTRACT is complete, PSAVE TOC and select LEP and compose. Compose all text and print on laser printer. SPELL check the text, catenate the .ERR files, SORT/NODUP, and print. (Written. FINALPASS.COM, PRINTALL.COM)

- @FINALPASS 'jobname'

r. Compare laser printed version with the printed copy supplied by the Sending System.

s. Note deviations and discrepancies for report.

t. Decide to fix and rerun or reject and return to the Sending System.

Table 5-1. Test Procedure for TAPEVAL Magnetic Tape Validation Program

Operator Action	Test Step/Expected Result	Pass/Fail Criteria
1. Mount/load tape to be tested on tape drive.	Tape mounted and at load point.	load/ready light displayed on tape unit.
2. Run TAPEVAL.COM command file.	Prompt displayed to enter tape volume lable.	
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4. Enter root directory at keyboard.	Prompt displayed for directory to contain tapelabel block scan results.	
5. Enter directory to receive SCANTAPE results.	Tapes moves across all documents on tape and thenrewinds. Display asks for directory to store FNVAL results in.	Successful tape Mount Message appears here.
6. Enter directory to store file name validations in FNVAL.	Display asks if it is OK to continue?	
7. Enter Y if FNVAL gave a good return.	Files are copied to system in preparation forheader scan.	Display asks for directory to contain DOCDECVALheader scan results.
8. Enter directory to store header results form DOCDECVAL execution.		TAPEVAL has run to completion.
9. Print the catalog and process log files.		

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TECHNICAL MANUAL

10/31/86

OVERHAUL INSTRUCTIONS WITH ILLUSTRATED PARTS BREAKDOWN

SPARK IGNITERS

PART NUMBER
AA124S-2
AA125S-5

AIRCRAFT ENGINE
USAF MODELS
F100-PW-100
F100-PW-200
F100-PW-220

PRATT & WHITNEY
GOVERNMENT PRODUCTS DIVISION
UNITED TECHNOLOGIES CORPORATION
F33657-70-C-0600
F33657-84-C-2014

T.O. 8E1-3-4-3/AITI

TECHNICAL MANUAL

OVERHAUL INSTRUCTIONS WITH ILLUSTRATED PARTS BREAKDOWN

SPARK IGNITERS

PART NUMBERS

PART NUMBER AA124S-2
AA125S-5

MODEL NUMBERS

AIRCRAFT ENGINE	USAF MODELS
F100-PW-100	F100-PW-200
F100-PW-220	

PRATT & WHITNEY
GOVERNMENT PRODUCTS DIVISION
UNITED TECHNOLOGIES CORPORATION
F33657-70-C-0600
F33657-84-C-2014

WARNING

DO NOT USE this copy for maintenance action. See WARNING PAGE for detail.

SECTION I

INTRODUCTION AND GENERAL INFORMATION

1-1. PURPOSE AND SCOPE.

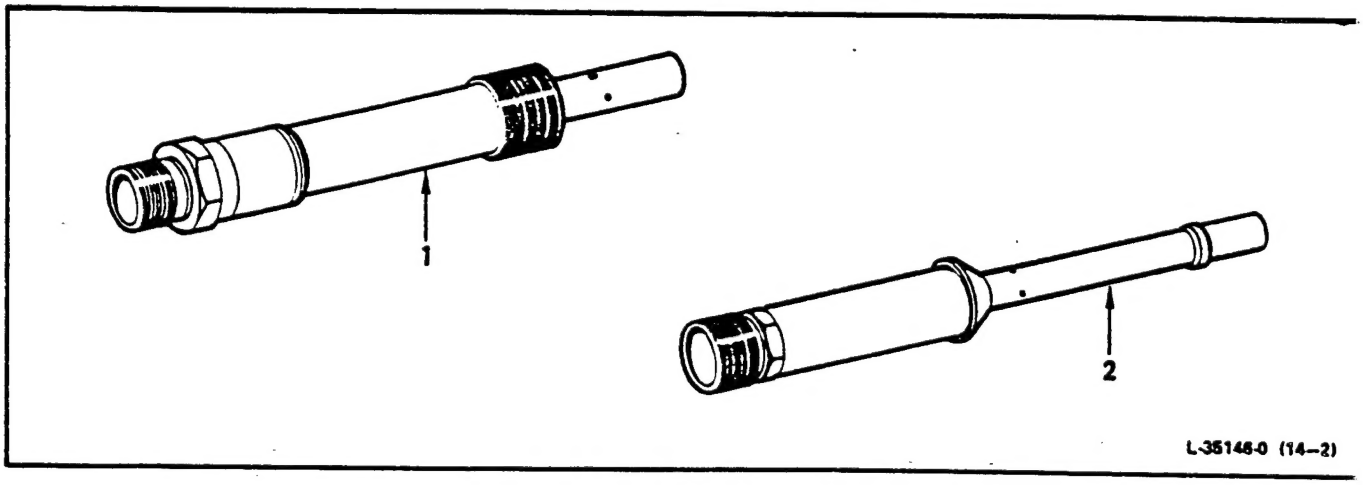
1-2. This manual contains descriptive data and instructions including parts breakdown for overhaul and test of main and augmentor spark igniters (Figure 1-1), manufactured for United Technologies Corporation, Pratt & Whitney, Government Products Division, P.O. Box 109600, West Palm Beach, Florida 33410-9600, U.S.A. The igniters are used on Pratt & Whitney F100 aircraft engines.

1-3. MODELS COVERED.

1-4. Sections I through IV of this manual contain overhaul and test instructions for main spark igniter PN AA124S-2 and augmentor spark igr PN AA125S-5. Parts information for all model included in Section V.

1-5. REFERENCES TO ILLUSTRATIONS AND TABLES.

1-6. In this manual, when the first reference i made to an illustration or table within its sect the first letter of the word figure or table will capitalized; for example, (See Figure 1-1.) or (. Table 1-1.). When the same illustration or tab is referenced again, the reference will be given small letters; for example, (See figure 1-1.) or (See table 1-1.).



1. Main spark igniter
2. Augmentor spark igniter

Figure 1-1. Spark Igniters

SECTION I

INTRODUCTION AND GENERAL INFORMATION

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Figure 1-1. Spark Igniters

1-7. WARNINGS, CAUTIONS, AND NOTES.

1-8. When necessary, procedural text will be supplemented by Warnings, Cautions, and Notes. These are defined as follows:

a. **WARNING:** An operating procedure, practice, etc., which will result in personel injury or loss of life if not correctly followed.

b. **CAUTION:** An operating procedure, practice, etc., which if not strictly observed, will result in damage to, or destruction of, equipment.

c. **NOTE:** An operating procedure, condition, etc., which is essential to highlight.

1-9. ABBREVIATIONS.

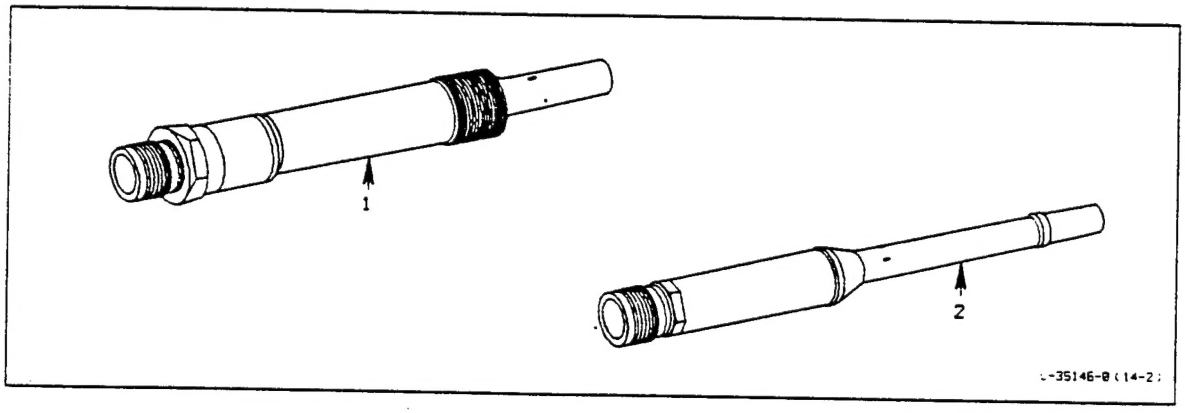
1-10. Abbreviations used in overhaul and testing instructions which are not covered in Military Standard MIL-STD-12 are listed below. See Illustrated Parts Breakdown for abbreviations used therein.

a. \ Hz - Hertz (cycles per second)

1-11. FUNCTIONAL DESCRIPTION.

1-12. The igniter provides a gap across which an electrical spark passes to ignite a fuel-air mixture. The igniter gap is ionized and becomes conductive by a surge of very high voltage from the high frequency coils of the ignition exciter. A storage

AITI Report 87-002
Exhibit 14b - Illus. As transmitted and processed



1. Main spark igniter
2. Augmentor spark igniter